

## Abundance and Size Composition of Vermilion Rockfish, *Sebastes miniatus* (Jordan and Gilbert 1880), from Sport Fishing Catches of San Quintín, Ensenada, Baja California, México

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**Abstract.**—The vermilion rockfish (*Sebastes miniatus*) is part of an extended group of fish species named rockcods or rockfishes that are distributed in waters of the Californias. This species is a common and popular fish caught by the commercial and recreational fishers. This study shows the results of the vermilion rockfish monitoring from the recreational fishing at San Quintín, Baja California, México during 2005. A total of 71 boats were counted from one-day (Saturday) monthly visits, and a total of 1,026 vermilion rockfish was registered, 60.4% of those were measured and weighed. Catches were highest during April ( $25.9 \pm 3.7$  SE vermilions per boat), lowest ( $5.8 \pm 3.9$  SE) in November and for the overall year averaged  $14.5 \pm 1.3$  SE. The sizes of vermilions rockfish were from 240 mm TL caught in November, and the biggest (680 mm TL) in December; the annual mean size was 448 mm TL ( $\pm 2.4$  mm SE). The recreational fishing at San Quintín, B.C. targeted almost all adult vermilion rockfishes, with only five individuals, of those measured, under the first maturity size (310 mm TL).

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### Introduction

Many fish species are shared between Baja California and California waters. The rockfishes (*Sebastes* spp.) comprised a large proportion of catches in the nearshore recreational fishery (Stephens et al. 2006), and commercial catch off California (Eschmeyer et al. 1983, Love 1996). Off Baja California, the rockfishes group also makes up a substantial part of both the commercial (Hernandez-Hernandez 2002; Rosales-Casián and González-Camacho 2003), and partyboat catch (Rodríguez-Medrano 1993). A great diversity of rockfishes (56 species) is found within the Southern California Bight, and although little information exists about the Pacific coast of Baja California, the number of species off northern and perhaps central Baja California is similar but species composition is different (Love et al. 2002).

Called vermilion rockfish, red rock cod or named simply “reds”, *Sebastes miniatus*, is a common fish species that is caught from, both, the coastal commercial and the recreational fishing; is found from Prince William Sound, Alaska south to central Baja California, Mexico (O’Connell et al. 1992), but are most abundant from central California southwards (Love 1996, Love et al. 2002).

Adults inhabit rocky reefs, kelp forests and canyons at depths of 15–467 m, but commonly at depths of 50–150 m, and can be found on artificial structures such as wastewater discharge pipes and oil drilling platforms (Love et al. 1990; 2002; 2003).

Vermilion rockfish showed strong site fidelity, but they may move from reef to reef, particularly in deep water, and may be associated with following schools of prey, such as squid (Lea et al 1999; Love 1981; Love 1996).

This species can grow to 91 cm TL and 6.8 kg, with an age record of 60 years old of one individual (Eschmeyer et al. 1983). The first maturity for male is at 32 cm TL and females begin to mature at 31 cm, all are mature at 37 and 47 cm, respectively and are single brooders (Love et al 1990). Half population is mature at 8 years, and peak spawning months are September at northern California and November in southern California (Ven Tresca 1992). Female vermilion rockfish appear to be reproductively active throughout the year and gravid was most abundant in September, and spent individuals were observed in the highest percentage during October–November (Lea et al 1999).

New larvae are pelagic and found near the surface frequently associated with algae (Ven Tresca 1999; 2001). Young-of-the-year appears in inshore shallow water beginning in February (Love 1996), and prefer a mix of hard-and-soft bottoms (Eschmeyer et al. 1983, Love 1996). Pelagic young feed small crustaceans (Ven Tresca 1992), and adults prey on other fishes (anchovies, lanternfishes, small rockfishes), octopi, squids, krill (Love 1996), and crustaceans as euphausiids, copepods, mysids, amphipods and carideans (Lea et al. 1999).

In California and during 2004, a total of 212 metric tons were landed of vermilion rockfish from the recreational fishing across 1,100 miles of coastline, and was seventh in the list of fish species abundance (CDFG 2005). In 2005 for south central California coast, vermilion rockfish was caught in a number of 1,218 individuals by the partyboats, and was second only after the *S. mystinus*, the blue rockfish, with 2,751 individuals landed (Stephens et al. 2006).

Little information about *S. miniatus* from Baja California is available. In a study of the recreational fishing at Bahía de Todos Santos (Ensenada, B.C.) realized during 1991, this species was not recorded in the first ten fish species caught, and classified as occasional fishing with an occurrence of 60% in boats (Rodriguez-Medrano 1993). This study is part of the catch characterization of the recreational fishing from San Quintín, Ensenada, Baja California, México. The objective of this study is to determine the abundance and the length structure of the vermilion rockfish caught by the partyboats throughout 2005.

### Methods

This study was conducted monthly from January to December 2005. San Quintín was selected from the Pacific coast of northern Baja California because of its importance as a fishing camp and we detected a recent increase in recreational fishing activity (Rosales-Casián and Gonzalez-Camacho, 2003). San Quintín is situated about two hundred kilometers south of Ensenada on the Transpeninsular Highway, and the boat ramp at El Molino Viejo (Old Mill) is used for both recreational and commercial boats. The recreational fishery at San Quintín is mainly conducted with small boats (up to 8 m long). This fishery involves a variety of ground and pelagic species from habitats up to 100 m deep. Sampling was conducted one day per month (Saturday) and we attempted to process the catch of the largest possible number of boats.

The identification of *S. miniatus* was according to Miller and Lea (1972). Vermilion rockfish catch from the individual boats were counted and measured upon arrival and before of their cleaning. The total and standard lengths (mm-TL, SL) were obtained with one measurement board with divisions to millimeter. If boats arrived while we were working fish, the vermilions were only counted.

Table 1. Numbers of vermilion rockfish caught and monthly mean catch per boat and per angler from the recreational fishing at San Quintín, B.C. México, (SE: standard error).

MONTH	NO. BOATS	TOTAL FISH	MIN.	MAX.	Catch per		Anglers	Catch per	
					Boat	SE		Angler	SE
January	5	55	1	33	11.0	5.79	12	4.6	1.41
February	5	46	1	15	9.2	2.65	12	3.8	1.25
March	5	106	12	27	21.2	2.78	10	10.6	1.39
April	9	233	16	47	25.9	3.65	23	10.1	1.71
May	8	185	12	40	23.1	3.27	21	8.8	1.39
June	5	33	3	16	6.6	2.42	12	2.8	0.72
July	5	64	2	31	12.8	5.79	11	5.8	2.18
August	8	80	1	28	10.0	3.85	17	4.7	1.81
September	7	55	1	18	7.9	2.48	15	3.7	1.26
October	4	75	3	35	18.8	8.05	13	7.8	3.56
November	4	23	2	11	5.8	1.93	10	2.3	0.55
December	6	71	5	19	11.8	2.43	16	4.4	1.45
Total	71	1026	1	47	14.5	1.33	172	6.0	0.57

Abundance was converted to catch per unit effort (CPUE) by dividing the monthly number of fishes by the monthly number of boat trips (Rosales-Casián and Gonzalez-Camacho 2003). Also, we calculated the fish per angler by dividing the number of monthly vermilion by the number of anglers per month. We used a Kruskal-Wallis test (ANOVA) to detect monthly mean differences.

The total lengths (TL-mm) were grouped by 20 mm length-classes and their frequencies were presented for all individuals and by seasons: winter (January–March), spring (April–June), summer (July–September), fall (October–December). Each monthly sample included four to nine boats, and over seasons increased to 14 to 22 boats. Sizes were transformed to (log<sub>10</sub>) and to determine seasonal differences in length means we used an ANOVA.

Results

During our visits at San Quintín in 2005, the catch of 71 boats and a total number of 1,026 vermilion rockfish was recorded; vermilions were caught in all months with the lowest number of boats recorded in October and November (four boats, each), and the highest in April with nine boats (Table 1). The minimum catch per vessel was one vermilion (January, February, August and September) to a maximum of 47 individuals by one boat in April. The lowest total monthly catch was recorded during November in four boats (23 vermilion rockfishes), and the highest total monthly catch was 233 individuals by nine boats during April, which caught from 16 to 47 individuals caught by singles boats (Table 1).

The catch per boat for the overall year averaged 14.5 ± 1.3 SE (SE: standard error) vermilions per boat (Table 1), with the highest mean computed for April (25.9 ± 3.7 SE vermilions per boat), and lowest (5.8 ± 3.9 SE vermilions per boat) for November. The distribution of the vermilion catch per boat on the complete year shows a large increase during March–May, with the highest mean during April; another peak was observed during October, and two lowest at June (6.6 ± 2.4 SE vermilions per boat) and November (5.8 ± 1.9 SE) (Fig. 1). There was a significant difference in the mean catch (vermilions per boat) between months of 2005 (Kruskal-Wallis H = 27.719, p = 0.0036). The catch per angler presented a peak during March to May (Table 1); the annual mean catch per



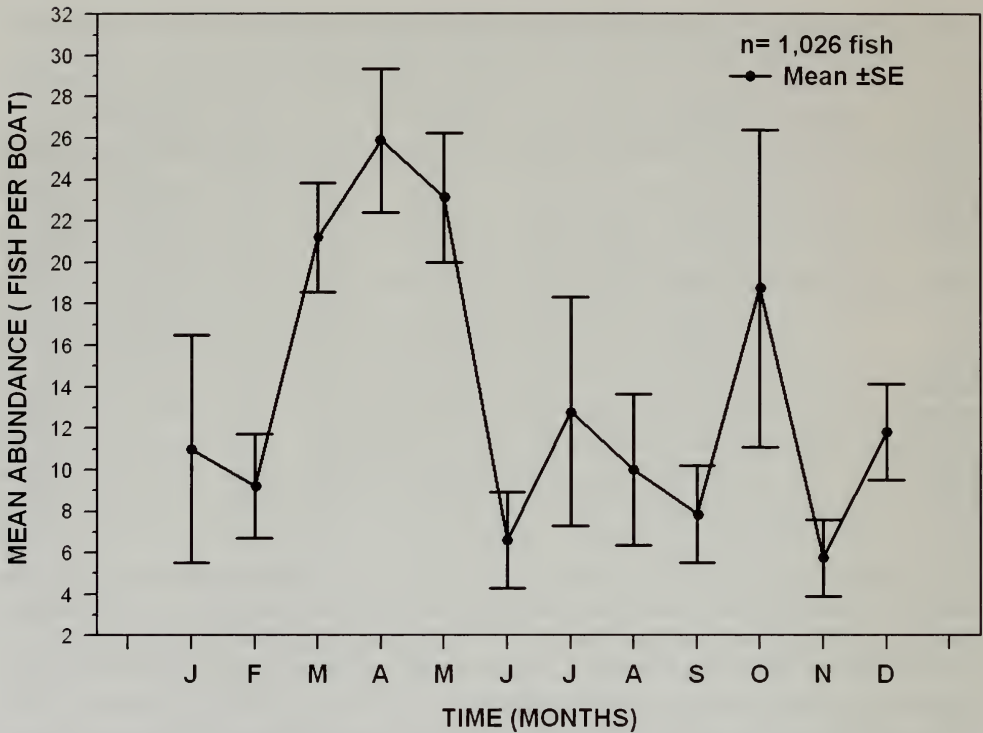


Fig. 1. Monthly mean abundance of vermilion rockfish (fish per boat) caught by sportfishing boats at San Quintín, B.C., México.

angler was 6.0 vermilions per angler ( $\pm 0.6$  SE), with the highest mean in March (10.6 vermilions per angler  $\pm 1.4$  SE) and the lowest during June ( $2.8 \pm 0.7$  SE) and November ( $2.3 \pm 0.6$  SE); the Kruskal-Wallis test showed differences in the monthly mean catch per angler ( $H = 25.064$   $p = 0.0089$ ).

A total of 620 vermilion rockfish (60.4% of total) were measured and weighed. The smallest fish was 240 mm TL caught during November, and the largest (680 mm TL) was found in December. The annual mean size was 448 mm TL ( $\pm 2.4$  mm SE), with the minimum mean size found in February (366.4 mm TL) and the maximum (477.5 mm TL) in May (Table 2). There was a significant difference in monthly mean TL (ANOVA,  $F = 19.025$ ,  $p = 0.000$ ).

The overall size distribution of the vermilion rockfish shows a mode at the size class of 400–419 mm TL (Fig. 2), with a main group size from 380–479 mm TL that represented 64.8% of the total fish measured. By seasons, the smallest sizes ( $< 260$  mm TL) were present in the catch of fall (Fig. 3), and specifically during November; The largest mean size was found for summer (mean: 466.9 mm  $\pm 3.5$  SE), and the lowest for winter (mean: 422.2 mm  $\pm 3.8$  SE); Differences between length mean by seasons were found (ANOVA,  $F = 21.201$ ,  $p = 0.000$ ).

### Discussion

Vermilion rockfish are popular in both the recreational and commercial fisheries (Love et al. 1990, Love 1996). They are highly prized by party and private vessel anglers throughout California with the majority of catches occurring from Monterey Bay south.

Table 2. Total length (mm) and monthly length mean of vermillion rockfish caught by recreational boats at San Quintín, Baja California, México.

MONTH	TOTAL FISH	MIN. LT (mm)	MAX. LT (mm)	MEAN	SD	SE
January	22	350	490	388.6	36.8	7.8
February	29	310	400	366.4	21.8	4.0
March	105	320	560	444.7	38.1	3.7
April	100	345	615	457.6	68.4	6.8
May	145	380	580	477.5	52.5	4.4
June	30	360	520	446.8	43.1	7.9
July	34	390	650	442.1	51.8	8.9
August	30	305	485	414.3	39.5	7.2
September	38	410	610	473.8	74.5	12.1
October	40	300	550	452.6	55.1	8.7
November	23	240	460	391.3	59.4	12.4
December	24	370	680	454.6	68.5	14.0
Total	620	240	680	448.0	60.9	2.4

Adults are taken primarily by gill net and hook and line, and make up a substantial part of the rockfish commercial catch off California (Eschmeyer et al. 1983, Love 1996). In the San Quintín, Baja California region, the vermillion rockfish is the most common fish species found in the recreational fishing industry. In our 2005 fish study, the vermillion rockfish was recorded in all months, with a peak catch from March to May, just after the storm season. The decrease in vermillion rockfish from June to September occurs as

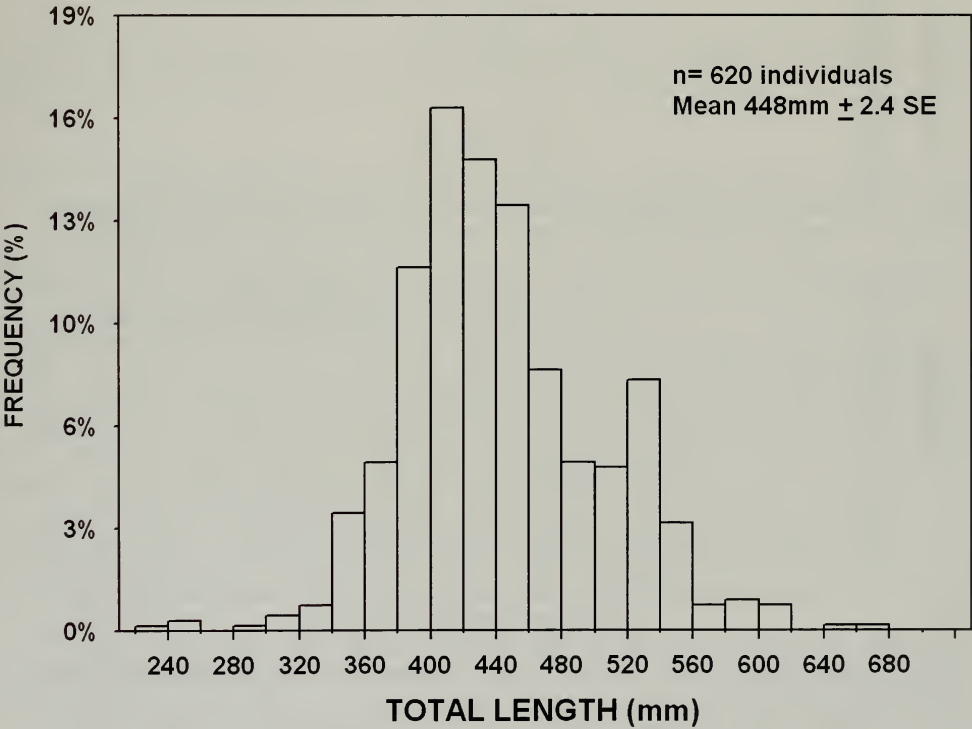


Fig. 2. Total length (mm) distribution (20 mm TL class) of vermillion rockfish from recreational fishing at San Quintín, B.C., México.

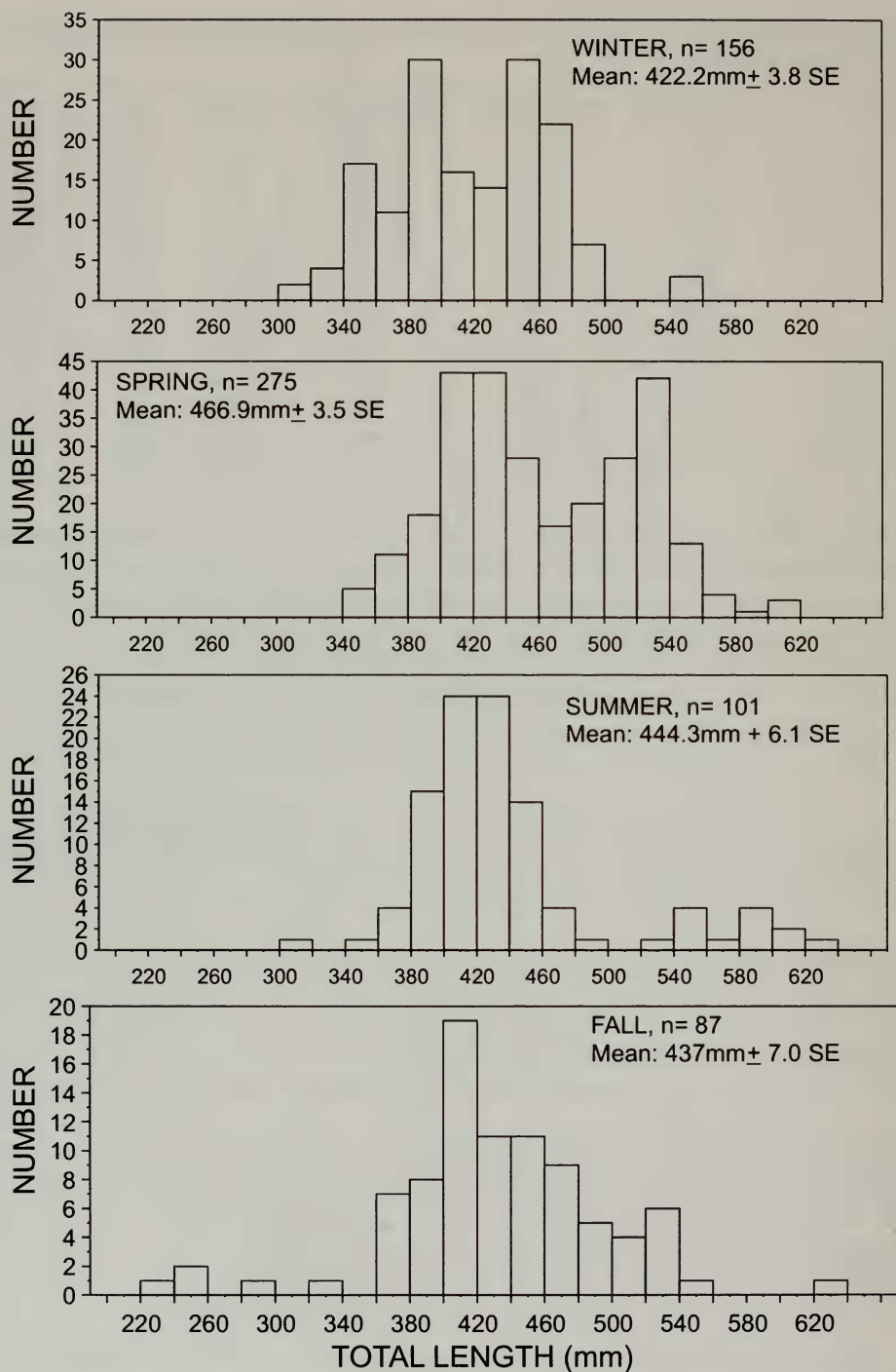


Fig. 3. Seasonal size distribution (20 mm TL class) of vermilion rockfish from recreational fishing at San Quintín, B.C., México.

fisherman turn to big pelagic fishes such as yellowtail, albacore, dorado, yellowfin tuna, barracuda, and marlin.

Small vessels comprise the recreational fishing fleet of San Quintín. It is strongly influenced by weather conditions, and this should be considered since there was a small number of fishing trips. With respect to the limits of fish caught, only six of the 71 boats landed the bigger numbers (31 to 48) of vermilion rockfishes at San Quintín, and considering that boats are rented by two to four anglers, the fish numbers per fisherman are lesser ( $6.0 \pm 0.6$  SE) than the mean number per boat (14.5 vermilions per boat). Vermilion rockfish mature at about 310 mm TL (Love et al. 1990). In the San Quintín catch, five individuals were caught under this length (240, 250, 260, 300 and 305 mm TL) only, and the first three individuals registered in November. This may be due to the recruitment of subadults to the adult habitats or population.

In Baja California, the rockfishes are important part of the commercial nearshore fishing (Rosales-Casián and González-Camacho 2003), in the recreational fishing were not recorded among the first ten fish species caught. However, it was taken with a frequency of occurrence of 60% among all boats surveyed (Rodríguez-Medrano 1993). Rockfish are also common fish species found at the Ensenada Seafood Market (Hernández-Hernández 2002). The recreational fishing at San Quintín, B.C., can be considered a healthy fishery by the reduced number of boat trips and the number of vermilion rockfish per boat landed. Practically, in 2005 almost all vermilion rockfishes were adult ( $>310$ -mm LT), with only five individuals under the first maturity size, and with a suitable annual mean size of 448 mm LT.

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